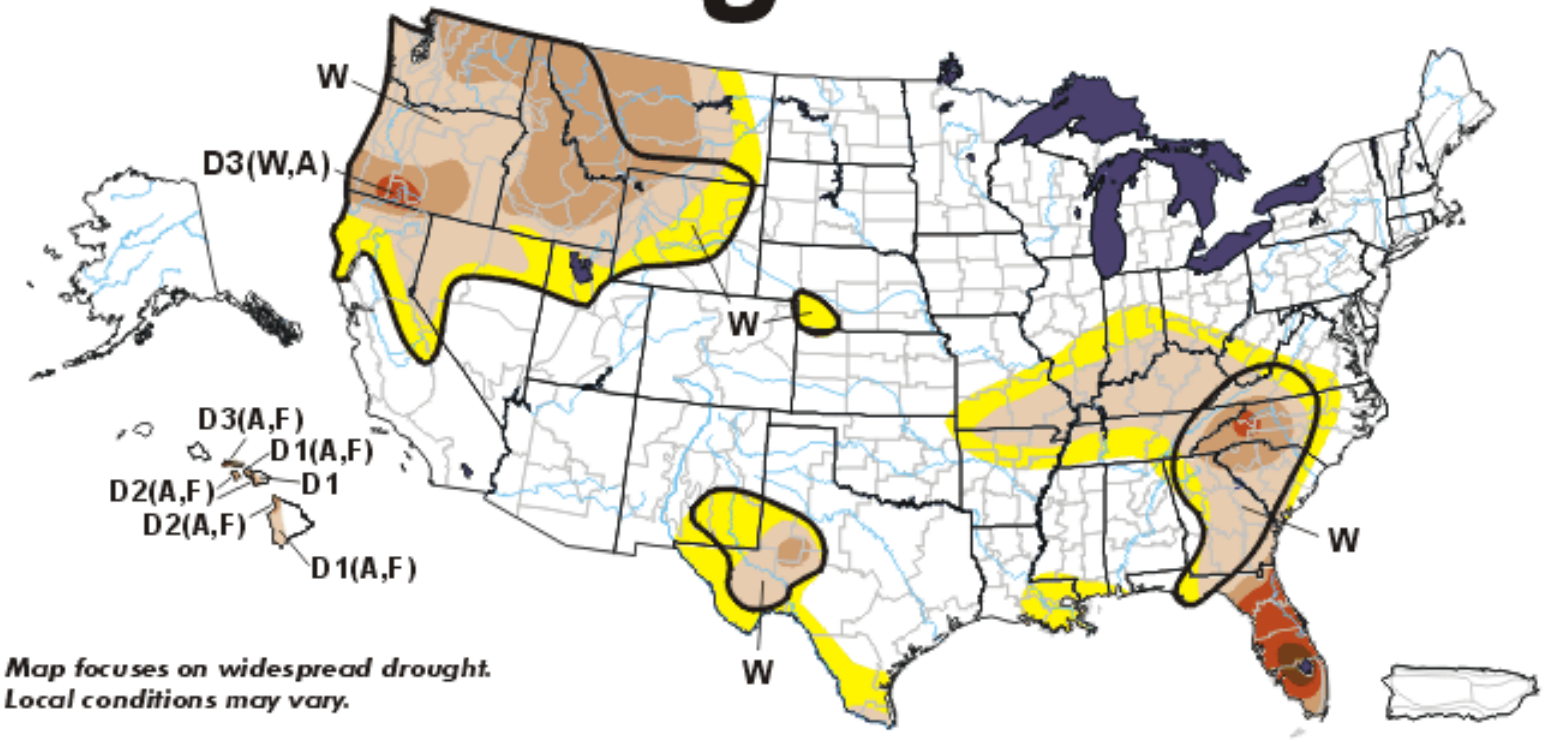
Water Quality Modeling of the Lower Columbia and Snake River During the 2001 Drought

U.S. Army Corps of Engineers,
Northwestern Division

May 1, 2001 Valid 8 a.m. EDT

U.S. Drought Monitor



Map focuses on widespread drought.
Local conditions may vary.

- D0 Abnormally Dry
- D1 Drought–Moderate
- D2 Drought–Severe
- D3 Drought–Extreme
- D4 Drought–Exceptional
- Delineates Overlapping Areas

Drought Impact Types:
A = Agriculture
W = Water (Hydrological)
F = Fire danger (Wildfires)
(No type = All 3 impacts)

See accompanying text summary for forecast statements
http://enso.unl.edu/monitor/monitor.html

● *Released Thursday, May 3, 2001* ●

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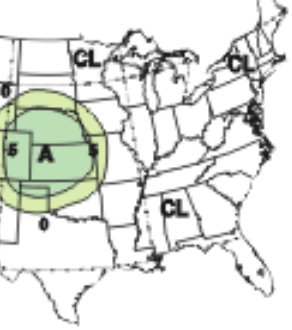
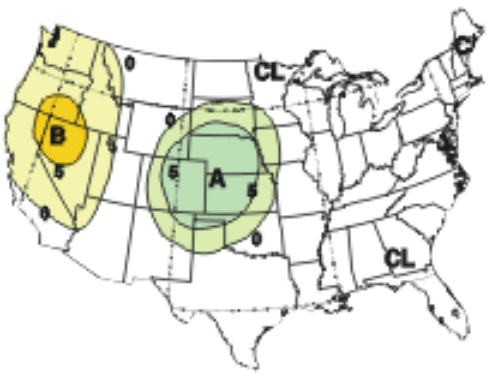
Drought Severity Classification

		RANGES						
Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Percent of Normal Precip	Standardized Precipitation Index (SPI)	Satellite Vegetation Health Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9	21-30	21-30	<75% for 3 months	-0.5 to -0.7	36-45
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested	-2.0 to -2.9	11-20	11-20	<70% for 3 months	-0.8 to -1.2	26-35
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	<65% for 6 months	-1.3 to -1.5	16-25
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	<60% for 6 months	-1.6 to -1.9	6-15
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies	-5.0 or less	0-2	0-2	<65% for 12 months	-2.0 or less	1-5



ecipitation

- December 2001



Precipitation

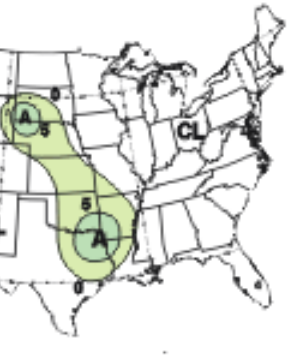
November 2001 - January 2002

Precipitation

December 2001 - February 2002

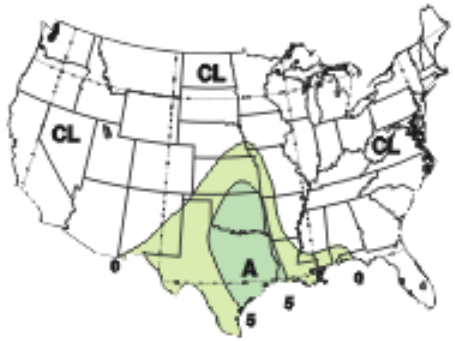
Precipita

January - Mar



ecipitation

ary - April 2002



Precipitation

March - May 2002

Precipitation

April - June 2002

Precipitat

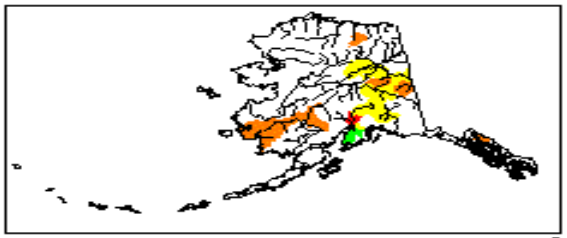
May - July

Climate Outlook

The key below is used to interpret each of the color versions of the ***Climate Outlook*** products. In areas where confidence in predictive skill has been established, the probabilities of the above normal, near normal or below normal categories are increased accordingly above the climatology level of 1/3 for each category. These probabilities are contoured at intervals using colors as depicted in the key below.
In those areas where the skill of our present prediction tools is not sufficient, the default is climatology (white color). The probabilities of experiencing each of the three categories (above normal, near normal or below normal) remain equally likely (1/3) in the white areas on attached maps.

Precip	Temp	Probability anomaly as shown on map	Probability of occurrence for each class			Most likely category
			A	N	B	
		40%-50%	73.3%-83.3%	23.3%-13.3%	3.3%	"Above"
		30%-40%	63.3%-73.3%	33.3-23.3%	3.3%	"Above"
		20%-30%	53.3-63.3%	33.3%	13.3%-3.3%	"Above"
		10%-20%	43.3-53.3%	33.3%	18.3%-28.3%	"Above"
		5%-10%	38.3-43.3%	33.3%	28.3%-23.3%	"Above"
		0%-5%	33.3-38.3%	33.3%	28.3%-33.3%	"Above"
		0%-5%	30.8%-33.3%	33.3%	30.8%-33.3%	"Near Normal"
		5%-10%	28.3%-30.8%	33.3%	28%.3-30.8%	"Near Normal"
		0%-5%	28.3%-33.33%	33.3%	33.3%-38.3%	"Below"
		5%-10%	23.3%-28.3%	33.3%	38.3%-43.3%	"Below"
		10%-20%	28.3%-18.3%	33.3%	43.3%-53.3%	"Below"
		20%-30%	13.3%-3.3%	33.3%	53.3-63.3%	"Below"
		30%-40%	3.3%	33.3%-23.3%	63.3%-73.3%	"Below"
		40%-50%	3.3%	23.3%-13.3%	73.3%-83.3%	"Below"
		0%	33.3%	33.3%	33.3%	"Climatology"

Spring and Summer Streamflow Forecasts as of April 1, 2001



Legend

- > 130% of Average
- 110 - 130% of Average
- 90 - 110% of Average
- 70 - 90% of Average
- < 70% of Average
- Not Forecast

Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

2001 April Final Water Supply On Columbia Basin

Sites	MAF	%Normal
GCL	37.5	59%
LWG	14.1	47%
TDA	56.1	53%

Drought Impacts in the Pacific Northwest

- Fish Protection
  - If water is not store now, not enough to flush spring and summer juvenile salmon migrating toward the ocean
  - If flow stop too early, risk dewatering redds, or nests, of threatened chum salmon below Bonneville Dam
- Hydropower Production
  - Rolling blackouts
- Irrigation
  - Put farmers out of business
- Recreation
  - Dry up boat ramps

Drought Impacts in the Pacific Northwest

- Water supply
  - Safe Drinking Water Act (Public Law 93-523)
  - The city of Vancouver and Clark Public Utilities tap underground aquifers for drinking water. If another year of drought, the aquifers will dry up.
- Water Quality
  - Water Pollution Control Act Amendments (Public Law 92-500)
  - Clean Water Act Section 208(b)(2)(1)(Public Law 92-500)
  - Lower summer flows and higher temperatures could impair water quality by concentrating pollutants and reducing the ability of streams to assimilate wastes.

Federal Responsibilities for Water Quality During /After Drought

- The Federal Government's role has been to provide financial assistance to citizens.

- Water-quality legislation has caused the Federal Government to take a more active approach to: allocate water, set policy objectives with water-use, consider interboundary issues, coordinate activities of governments in meeting water supply needs.

Corps' Northwestern Division, Reservoir Control Center Water Quality Section Responsibilities

- Corps Dissolved Gas Monitoring Program
- Regional Forum Activities
- Regional Modeling Tools
- Etc…

Map of Corps Dissolved Gas Monitoring Program

Regional Forum Activities - TMT

2001 Water Management Plan for the Federal Columbia River Power System

- Federal reservoir and dam operations to augment flows for fish
- Power generation
- Turbine outages
- Spill scheduling
- Water temperature management
- Total dissolved gas management
- Special operation for research

http://www.nwd-wc.usace.army.mil/TMT

Regional Modeling Tools

- 1D Mass 1 (Battelle)
- 2D MASS 2 (Battelle)
- SYSTDG (Corps Waterways Experiment Station)

Water Quality Section use of MASS 1

Water management operations for temperature control in the system by releasing cooler water from Dworshak Dam.

MASS1 – Modular Aquatice Simulation System Model 1D

- Unsteady flow in branched channel systems
- Physics – Based Model
  - Mass and momentum conservation
- Cross-Sectional Averages
  - Discharge, Stage, Temperature, Total Dissolved Gas, and other constituents Physics
- Hydraulic Structures
  - Dams

1D Model Input Data

- Water Inflow Discharge, TDG Inflow and Temperature Inflow Data
- Project Operations
  - Hourly, Discharge, Forebay Elevation
  - TDG Production
- Bathymetry Data
- Meteorological Data: Wind Speed, Air & Dew Point Temp, Solar Radiation, and Barometric Pressure

Outputs of Mass1 at DWR

Outputs of Mass1 at LWG

Outputs of Mass1 at IHR

Outputs of Mass1 at MCN